

# WEATHER-READY NATION



**NOAA's NATIONAL WEATHER SERVICE**



**STRATEGIC PLAN 2011**

# NOAA'S NATIONAL WEATHER SERVICE STRATEGIC PLAN: Building a Weather-Ready Nation

JUNE 2011

## Mission

**P**rovide weather, water, and climate data, forecasts and warnings for the protection of life and property and enhancement of the national economy

## Vision

**A** Weather-Ready Nation: Society is Prepared for and Responds to Weather-Dependent Events

## Goals

- Improve weather decision services for events that threaten lives and livelihoods
- Deliver a broad suite of improved water forecasting services to support management of the Nation's water supply
- Enhance climate services to help communities, businesses, and governments understand and adapt to climate-related risks
- Improve sector-relevant information in support of economic productivity
- Enable integrated environmental forecast services supporting healthy communities and ecosystems
- Sustain a highly-skilled, professional workforce equipped with the training, tools, and infrastructure to accomplish our mission

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# LETTER FROM THE ASSISTANT ADMINISTRATOR

**W**eather, water, and climate affect each of us every-day – whether it's a tornado or flood that threatens life and property, a volcanic ash eruption or solar flare that disrupts air traffic, or just a minor inconvenience due to hot and humid weather. The National Weather Service (NWS) has the responsibility to provide weather, water, and climate information to protect life and property and enhance the national economy. We have been serving America in this way for 140 years. By our 150th anniversary, we want America to be a Weather-Ready Nation.

However, population growth, growing infrastructure threats, and an increasingly interdependent economy are creating new challenges for the Nation. At the same time, science and technology are rapidly advancing and providing potential solutions that will enable the National Weather Service to better meet our country's needs. This Strategic Plan is our effort to anticipate service needs over the next couple of decades, project what science and technology could allow, and establish meaningful outcome-oriented goals and objectives as we seek to build a Weather-Ready Nation.

The Strategic Plan also provides a strategic framework that will guide our organization and investment over the next decade. We understand fully the Nation's current economic realities; and, it is for that reason that we must improve and demonstrate the economic value of our weather, water, and climate services. While this Strategic Plan is not cost-constrained, our subsequent roadmap and implementation plans will narrow our focus within the available budgets. These planning efforts will prepare NWS to meet the opportunities and challenges of the future.

Our Strategic Plan is aligned with NOAA's Next Generation Strategic Plan and is the result of a collaborative effort by our employees and the NWS Employees Organization (NWSEO), NOAA and NWS management, and our partners in the public, private and academic/research sectors. We closely reviewed the input and incorporated the community's thinking into our planning.

Our success in "Building a Weather-Ready Nation" depends critically on teamwork – within NWS and NOAA and with our partners in the public, private and academic/research sectors.

We will continue close collaboration with our NOAA colleagues as we develop more detailed strategies and implementation plans. Our success depends on all of NOAA's capabilities. Collectively, we must be creative and innovative in our thinking, willing to embrace change, and committed to achieving success that benefits all Americans – especially during challenging economic and budgetary times.

We remain committed to open dialogue every time we propose specific changes in our products and services. Following this path will enable NWS to become more capable, better equipped, and more agile in our service delivery. We'll provide more timely and accurate weather, water and climate information for decision makers at all levels and contribute to safer, healthier, and more productive communities, ecosystems, and economies.

## **Dr. John "Jack" L. Hayes**

NOAA Assistant Administrator for Weather Services  
and Director, National Weather Service  
National Oceanic and Atmospheric Administration

# INTRODUCTION

As the world has changed, so too has the NWS, advancing scientific and technical capabilities to better meet the needs of Americans.



# INTRODUCTION

The National Weather Service (NWS) has played a key role in protecting American lives and property for 140 years. The timely provision of reliable weather, water, climate, and environmental information has supported the Nation's social and economic development. NWS offices in communities across the United States and its territories, supported by regional

In 1955, an F5 tornado devastated the town of Udall, Kansas, killing or injuring roughly 68 percent of the town's population of about 500 people. In 2007, an EF-5 tornado—similar in size and strength to the Udall tornado—ripped through Greensburg, Kansas, destroying over 90 percent of the town. Emergency managers on the scene expected a death toll in the hundreds. Unlike Udall, however, Greensburg residents were prepared, thanks to advances in the NWS warning system, radar improvements, and a strong partnership between NWS, emergency responders, the media, and the private sector. The number of casualties in Greensburg was less than about five percent of the town's population of nearly 1,500—far fewer than what had occurred in Udall half a century earlier.

and national centers, provide the authoritative information needed by Americans and American businesses to plan and prepare for, mitigate, and respond to natural and human-caused events.

The NWS is part of the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA), an agency with a diverse mission to understand and anticipate changes in the climate, weather, oceans, and coasts; to share that knowledge and information with others, and to conserve and manage marine resources. The NWS contributes to NOAA's mission with expertise in weather, water, and climate prediction. NOAA's commitment to science, service, and stewardship informs society to respond and adapt to environmental conditions within a changing and uncertain world.

As the world has changed, so too has the NWS. We have advanced our scientific and technical capabilities to better meet the needs of Americans. During the 1980s and 1990s, NWS deployed state-of-the-art observing and computing systems, improved modeling capabilities, re-aligned the organization to better deliver services, and made substantial investments in training and recruitment. The result was an organization with a greater capacity to provide timely information to protect lives and property.

Today our science and services continue to evolve and improve to meet emerging needs. For example, NWS forecasters are working closer than ever with emergency responders to prepare for and mitigate the impacts of natural and human-caused events. Space weather prediction and warnings are helping protect our Nation's infrastructure. Climate outlooks are contributing to the management of the Nation's water resources, energy supply, and food security. NWS data and information are becoming increasingly valuable to our society. We are also responding to the changing ways people communicate, network, and share information, and we are using new technologies to make information more accessible and interoperable.

Weather, water, climate, and environmental information and services will play a greater role in the significant decisions we make as individuals and as a society – from the quantity and quality of water we need and the quality of the air we breathe, to the generation and distribution of renewable energy, and the safe passage of our country's highways, railways, seas, and airways. The weather and climate enterprise will be asked to do even more to make everyday life safer, healthier, and more productive.

# NWS VISION

*A Weather-Ready Nation: Society is Prepared for and Responds to Weather-Dependent Events*



# NWS VISION

## *A Weather-Ready Nation: Society is Prepared for and Responds to Weather-Dependent Events*

New and evolving needs from society call for the National Weather Service to shift from the way we forecast and warn today to an impact-based decision support services approach.

This means we must place an increasing emphasis on weather-dependent events that significantly affect people, their

livelihoods and the economy. By weather-dependent we mean events caused by weather and events with outcomes depending on weather – for example, oil-spill response and recovery.

accurate forecasts and timely warnings and build in improved understanding and anticipation of the likely human and economic impacts of such events. We must enable our users to better exploit NWS information to plan and take preventive actions so people remain safe, less damage is done to communities, businesses, and the environment, and economic productivity is maximized.

Impact-based decision support services, then, is the overarching paradigm from which the NWS will deliver weather, water, and climate-related services. This is not a new paradigm for the NWS – we have been supporting public safety officials for nearly one-and-a-half centuries – and we have an opportunity now to do even more to help America make better decisions.

This new focus has four elements: better understanding of societal impacts, making our information more relevant to decision makers, participating directly in decision

making for those decisions fundamental to the role of government, especially the protection of life and property, and counting on market forces to provide diverse decision-support services across the entire economy. Specifically, it will require the NWS to:

- Understand the needs of our users and how weather, water, and climate data and information can be applied to create value and benefit. Operationally this means a focus on maintaining continuous situational awareness and interpreting information in the context of its impact on society;
- Produce high-utility, decision-relevant data and information sensitive to societal, economic, and cultural criteria, communicated directly or through commercial partners in ways that people fully understand and respond;
- Deliver interpretive services, based on NWS forecaster expertise to key decision partners for public safety and policy;
- Implement information management, data discovery, and collaboration tools required to support this vision;

We must go beyond the production of



- Foster the growth of America's weather and climate industries to provide diverse services to the entirety of U.S. society and the economy.

### What is a High-Impact Event?

No standard, nationwide criteria define a high-impact event. It may impact millions of people or one sector, and it may vary in timing or location.

It is any weather-dependent event that significantly impacts safety, health, the environment, economic productivity, or homeland security, such as:

- Major events such as tornadoes, hurricanes, and tsunamis
- Persistent drought
- Thunderstorms in a congested air space
- Rains that trigger flooding and cause agricultural run-off, leading to harmful algal blooms and dead zones
- Geomagnetic storms that disrupt energy distribution and communication systems
- Snow squalls at rush hour
- An above-average hot day
- Coastal inundation
- Changes in Arctic climate

Scientific and technical advancements are essential enablers for providing impact-based decision support. Advanced information management approaches will create dynamic, integrated data available on-demand, which will serve as the technical foundation of NWS operations and diverse applications outside of the NWS.

The result will be a common, nationally-consistent, real-time weather picture, allowing NWS forecasters to better maintain situational awareness, focus on scientific interpretation, and monitor forecast challenges.

The forecast team will be at the center of the information system producing and delivering information to enable human decisions. Linking social and physical sciences to produce and communicate information will be critical to our success. Integrated observations, Earth system models over a wider range of spatial

and temporal scales, quantifiable forecast uncertainty, and advanced technologies will enable more accurate and timely forecasts and warnings.

These measures will extend the window America has to prepare for weather-dependent events that impact society.

Our workforce and partnerships are vital to the success of impact-based decision support. NWS will develop strategies and commit resources to enhance the capabilities of our entire workforce. We will add to the core skills of our scientists, meteorologists, and hydrologists to help them better understand and communicate the risks and impacts implied by our forecasts. We will focus on providing our engineers, technicians, managers, and



administrators with the skills to be more effective problem solvers and collaborators.

We want to recruit and partner with people from other disciplines: economists, behavioral scientists, ecologists, oceanographers, and health experts, among others. We want to better leverage the expertise and resources of our partners in the public and private sectors.

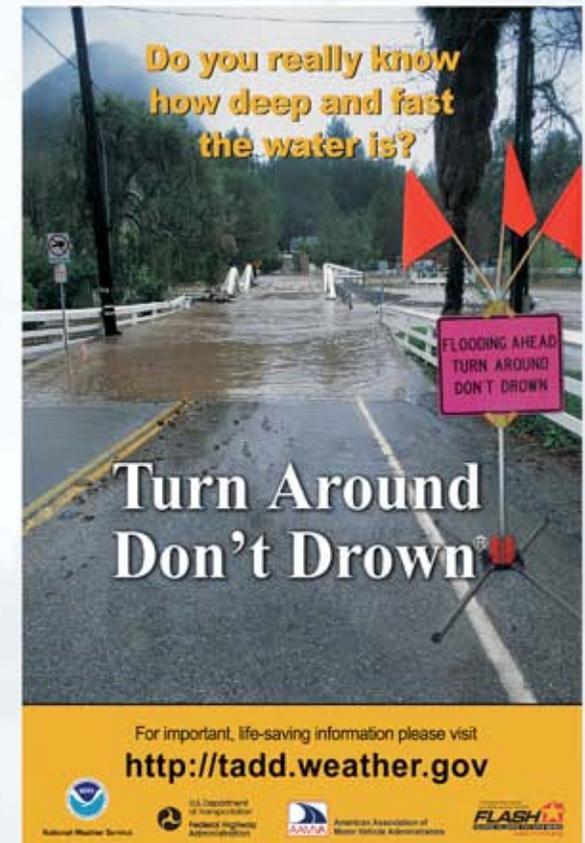
## Achieving Our Vision

This section outlines the details of our Strategic Plan. It describes the long-term, mutually supportive goals, which contribute to beneficial outcomes for society. These are outcomes we cannot control alone, but ones where our capabilities can have a positive impact on global decisions and the many challenges we face as a Nation.

Examples of such outcomes are defined as measures of success for each goal. Below each goal, objectives and high-level strategies focus on service delivery and science and technology. Many of the strategies support the achievement of multiple goals. Later sections of this plan describe our approach to implementation.

## Summary of Goals

- **GOAL 1:** Improve weather decision services for events that threaten lives and livelihoods
- **GOAL 2:** Deliver a broad suite of improved water forecasting services to support management of the Nation's water supply
- **GOAL 3:** Enhance climate services to help communities, businesses, and governments understand and adapt to climate-related risks
- **GOAL 4:** Improve sector-relevant information in support of economic productivity
- **GOAL 5:** Enable integrated environmental forecast services supporting healthy communities and ecosystems
- **GOAL 6:** Sustain a highly-skilled, professional workforce equipped with the training, tools, and infrastructure to meet our mission





# GOAL 1

Improve Weather  
Decision Services for Events  
that Threaten Lives and Livelihoods

## GOAL 1: Improve Weather Decision Services for Events that Threaten Lives and Livelihoods

Urbanization and a growing population are increasingly putting society in harm's way of weather, water and climate events. For a growing number of people living in coastal communities, hurricanes, typhoons, and tsunamis threaten livelihoods and cause major damage to property and infrastructure.

Tornadoes can take lives and destroy entire communities within a matter of minutes, while wildfires can burn for weeks threatening homes and natural habitats. Indirect impacts of these events, such as infrastructure failures, illness, and emotional trauma, can be just as significant.

This goal seeks to minimize or even prevent such human and economic impacts.

**Measures of Success:** Improved community emergency preparedness leading to avoidance of fatalities from weather-dependent events; cost avoidance from unnecessary evacuations and property damage; more rapid post-event recovery

**Objective:** Provide demand-driven, impact-based weather services

### Strategies for Achieving:

- **User engagement:** Increase engagement with users and core

partners to improve knowledge of user needs and better understand how users apply weather data and information to make decisions and manage risk. The NWS will also take steps to better understand the impacts of weather and weather information on society, economy, and homeland security;

- **Decision-relevant Data & Information:** The knowledge gained from engaging users will allow the NWS to provide more specific, user-centric products and services that better enable decision making. For example, forecasts will compare weather risk to tolerance levels based on societal or economic impacts, communicating the potential social, economic, and environmental impacts. NWS warning criteria will be redefined to focus on a broader range of high-impact weather-dependent events targeting those at risk;

- **Interpretive Services:** Increase direct, interpretive services to public sector and emergency management officials for incidents of national, regional, or local significance. This will require a cadre of NWS professionals trained to respond to a variety of events and the tools to enable



People who live along rivers and other inland waterways face increasing disruption because of more frequent and devastating flooding.

Winter storms paralyze cities and regions for days and cost billions in cleanup and lost productivity.

collaboration, communication, and problem-solving with partners, users, and the NOAA workforce;

- **Outreach & Education:** Improve the preparedness and resiliency of those at-risk to the impacts of weather-dependent events through impact-based outreach and education. Continue to promote community preparedness programs, such as TsunamiReady™ and StormReady®;
- **Partnerships:** Continue to engage and collaborate on global, national, and regional issues; and strengthen and broaden effective partnerships with other agencies, public and private sector partners, including America's weather and climate industry.

**Objective:** Utilize emerging science and technology to improve accuracy, timeliness, and precision of forecasts and warnings

### Strategies for Achieving:

- **Observations:** Integrate disparate observing systems by working with NOAA, public and private partners. NWS will also

leverage non-NWS observing systems to fill observation gaps with a focus on the planetary boundary layer, urban areas, and the Arctic;

- **Modeling & Prediction:** Improve data assimilation and high-resolution models within an Earth system framework to address forecast challenges such as thunder-

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***The NWS will also take steps to better understand the impacts of weather and weather information on society, economy, and homeland security***

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storms, floods and flash floods, hurricanes and cyclones, with attention to urban areas and the Arctic;

- **Forecast Uncertainty:** Develop and implement an advanced capability to generate high-quality forecast uncertainty information through ensemble models and forecast system improvements;

- **Forecaster Tools:** Develop and implement, with research community and other partners, forecaster tools that support data mining, enhanced visualization, smart decision assistance, and forecaster coordination and collaboration;
- **Data Access:** Extend access to weather, water, climate, and environmental data using national and international systems and standards, such as the 4D Cube;
- **Decision Support Tools:** Develop and implement, with users and partners, tools to apply weather, water, and climate information, including forecast uncertainty, into user decision processes and systems;

- **Social Science:** Integrate social science research, methods, and capabilities into science service areas, forecaster tools, and decision support systems;
- **Partnerships:** Build and strengthen partnerships to find and influence emerging technologies and define requirements;
- **Transition of Research:** Develop, in partnership with the research community, common modeling and operating infrastructures as well as test beds to facilitate scientific and technological development and to accelerate the transition of research into operations.





Deliver a Broad  
Suite of Improved Water  
Forecasting Services to Support  
Management of the Nation's Water Supply

## GOAL 2: Deliver a Broad Suite of Improved Water Forecasting Services to Support Management of the Nation's Water Supply

Whether too much, not enough, or of poor quality, water is a major national challenge. Water for homes, agriculture, energy, and industry is already in short supply. In 2007, Atlanta, Georgia, came within weeks of running out of water due to drought.

That same year Lake Superior dropped to its lowest level in 81 years because of drought, warmer weather, and rising lake temperatures.

The lower water level had serious economic and

environmental consequences, including dried up wetlands, power plants running at half capacity, and cargo ships carrying partial loads.

Water quality is a growing challenge for communities and ecosystems and is being affected by changing water temperatures and an increase in salinity, nutrients, and other pollutants.

A growing population and more frequent, persistent droughts and floods brought on by a changing climate will only make the Nation's water management all the more challenging. This goal seeks to integrate and extend NWS water prediction capabilities to provide information and forecasts for a full suite of water forecast services. NWS will collaborate with users and public and private partners to better enable water resource managers to make preventative, proactive decisions in a changing and uncertain environment.

### Measures of Success:

Reduced economic loss and property damage from flooding; more efficient management of municipal water supplies using integrated water forecasts and information; economic, ecological, and agricultural benefits realized from forecasting water temperature, soil moisture, and other parameters

**Objective:** Develop cross-government, integrated water resource services

### Strategies for Achieving:

- **Water Resource Services:** By partnering with other federal water agencies, including the Environmental Protection Agency (EPA), expand services to provide forecasts for such parameters as water flow, temperature, quality, dissolved oxygen content, and soil moisture conditions for inland and coastal watersheds;
- **Decision Support Tools:** Develop and deliver decision support products and tools (with multiple government partners, including the U.S. Geological Survey and the U.S. Army Corps of Engineers) for water resource



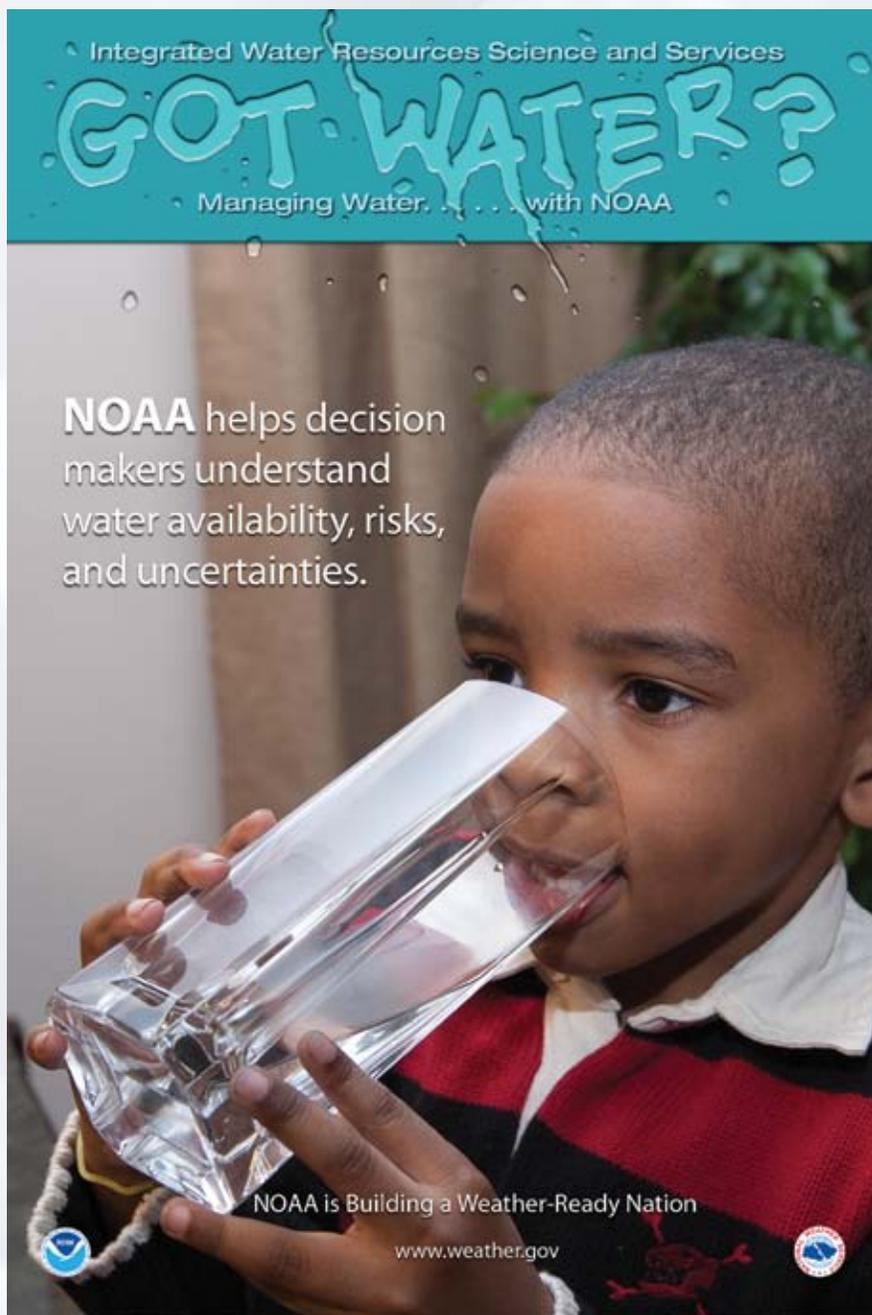
Integrated Water Resources Science and Services

# GOT WATER?

Managing Water... with NOAA

**NOAA** helps decision makers understand water availability, risks, and uncertainties.

NOAA is Building a Weather-Ready Nation  
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managers, focusing on weather and climate-related impacts for arid and coastal watersheds, based on interoperable high-resolution summit-to-sea water resources data and information;

- **Outreach & Education:**

Expand education and outreach activities to better inform citizens, water resource and environmental managers of water demand, supply and quality issues.



**Objective:** Advance science and technology to improve and expand water forecasting

### Strategies for Achieving:

- **Observations:** Leverage our partners' observations to fill critical weather and water observing gaps;
- **Modeling & Prediction:** Develop higher resolution coupled models for rivers, lakes, and estuaries based on a greater understanding of precipitation, temperature, evaporation, and other hydrologic processes to address high and low flow, storm surge, and inundation, support flood and flash flood prediction, while reducing hydrologic forecast uncertainty;
- **Partnerships:** Advance hydrologic services by leveraging science and technology across NOAA, other agencies including the U.S. Geological Survey and the U.S. Army Corps of Engineers, the private sector, and academia.





Enhance Climate Services  
to Help Communities, Businesses,  
and Governments Understand and  
Adapt to Climate-Related Risks

## GOAL 3: Enhance Climate Services to Help Communities, Businesses, and Governments Understand and Adapt to Climate-Related Risks

Changes in climate affect all aspects of our ecosystems, society, and economy. Changes in climate may increase average global temperatures, melt sea ice, change precipitation patterns, and produce rising sea levels. Severe weather may increase in intensity and frequency.

impacts terrestrial, coastal, and marine ecosystems; but, also provides opportunities for opening new sea routes.

This goal supports the efforts of NOAA to deepen scientific understanding of climate, deliver climate services from global to local scales, and improve public knowledge about the impacts of a changing climate on their lives, businesses, and communities.

In February 2010, the Department of Commerce announced its intent to establish a Climate Service line office in NOAA that would consolidate key climate science and service assets under a single management structure. NOAA's proposed Climate Service will allow NOAA to meet increasing public and private demands for climate science and services that extend from seasons out to years and decades.

The NWS continues to support NOAA's Next Generation Strategic Plan Climate Goal by providing complementary

science and services to the resources that exist across multiple line offices. The NWS is key to ensuring NOAA is able to provide a seamless suite of weather and climate services – from minutes to decades – that are easily accessed and understood.

NOAA will continue to leverage NWS's expertise in monitoring and predicting, as well as our service model that includes an extensive national, regional, and local infrastructure to help deliver climate services. Our local community presence will facilitate NOAA's efforts to identify and address the climate-related needs of decision makers and planners.

The NWS will direct our Weather Industry partnership experience towards promoting the growth of the private Climate Service Industry.

The NWS will advance NOAA's ability to prepare communities for climate impacts.



Changes in climate may impact water resources—too much, too little, and poor quality. Impacts from changes in climate may be both positive and negative, such as in the Arctic, where melting sea ice

## Measures of Success:

Economic benefits in areas such as agriculture, transportation, water, and energy as a result of impact-based climate services; improved preparation and response to weather-dependent events based on climate forecasts; better management of environmental resources based on climate forecasts

**Objective:** Enhance NWS services to support development and delivery of NOAA climate services

## Strategies for Achieving:

- **Climate Forecasts:** Create a seamless suite of forecasts that look out beyond two weeks to support response and preparedness to changes in climate that incorporate research advances from within NOAA and other partners, including the commercial weather and climate industries;
- **Decision-relevant Data & Information:** Engage users, in coordination with other stakeholder engagement assets from across NOAA's line offices, to better understand their climate information needs and deliver an expanded

climate service portfolio that integrates social and economic factors into physical science-based products developed in collaboration with NOAA and other partners;

- **Partnerships:** Strengthen local, state, regional, national, and international partnerships across various sectors; foster growth of an emerging climate service industry to serve diverse needs of America's economy.

**Objective:** Improve and expand climate modeling for time scales from weeks and seasons to years

## Strategies for Achieving:

- **Observations:** Advance climate-quality data observations and data assimilation techniques, and leverage NWS, NOAA, and partner observing systems;
- **Modeling & Prediction:** Working with NOAA, and partners, improve the capability to simulate and predict climate on multiple time scales within an Earth system framework, including the quantification of forecast uncertainty. NWS will also collaborate with partners to complete updates to the Nation's precipitation frequency



estimates, incorporating the effects of climate change and developing techniques to update maximum precipitation estimates;

- **Transition of Research:**

Develop, in partnership with the research community, common modeling and operating infrastructures and test beds to facilitate scientific and technological development and to accelerate the transition of research into operations.



# GOAL 4



Improve Sector-Relevant  
Information in Support of  
Economic Productivity

## GOAL 4: Improve Sector-Relevant Information in Support of Economic Productivity

**A**voiding economic losses and maximizing economic benefits from routine and high-impact weather-dependent events are critical to maintaining global competitiveness and homeland security. Today, transportation is disrupted by storms, hurricanes, and flooding, causing delays, and loss of lives and property.

Weather accounts for 70 percent of all air traffic delays, many of which are avoidable, costing tens of billions

of dollars to the economy each year. Many forms of renewable and alternative energy are weather and water-driven and sensitive, requiring accurate, reliable forecasts to make critical production and management decisions.

Extreme weather, like hurricanes, can disrupt oil and gas production, and inaccurate forecasts can have huge economic impacts. Transmission of energy is vulnerable to extreme

temperatures and geomagnetic solar storms. Unforecasted space weather activity can also interfere with communications and transportation systems, causing disruption and major economic loss. In the agriculture sector, global food supplies, ranging from crop yields to health of livestock, are impacted by weather, water, and climate. For commercial and recreational fishermen, an accurate forecast of the day's weather has significant economic and safety implications.

Achieving this goal requires the collaboration and partnership of many government agencies and multiple sectors, while remaining true to appropriate boundaries between NWS and America's weather and climate industry. The NWS views our role as developing better, more accessible data and information that support government partners, enable America's weather and climate industry to better serve its clients, and enable industry as a whole to better anticipate, plan, and make key decisions to increase economic productivity and protect lives and livelihoods.

## Measures of Success:

Economic benefits in weather-sensitive sectors of the economy, including transportation (air, land, and water), energy, and agriculture through efficiency gains, damage avoidance, and increased value from services provided by America's weather and climate industry

**Objective:** Strengthen use of weather-dependent information for informed decision making and risk management

## Strategies for Achieving:

Achieving this objective will require service strategies, particularly delivery approaches for addressing the unique needs of weather-sensitive industries.

NWS and partners will collaboratively engage with users at local, regional, and national levels to better understand evolving service needs and how NWS data and information services can be applied to improve decision-making and manage risk. Targeted opportunities include the following:

- **Energy:** Engage the renewable energy sector, other agencies, and partners like the weather and climate industry to expand observations, improve short-range to seasonal forecasts, and promote technical exchange and research. Identify opportunities to improve the utilization of weather, water, climate, and space weather information to improve the efficient transmission of energy;

- **Transportation:**

**Aviation:** Enable a more efficient and safer National Airspace System by providing a consistent environmental picture to the Federal Aviation Administration through the Next Generation (NextGen) transformation of weather, volcanic ash, and space weather services:

**Surface:** In collaboration with NOAA, America's weather and climate industry, and surface transportation users, improve the integration, access and quality of weather, water, and climate data and information to improve the safety, mobility, and efficiency of roadways, marine, rail, and pipeline systems.

- **Agriculture:** Participate in national and international efforts to tackle global food supply and water resource challenges by contributing modeling and prediction capabilities.



**Objective:** Improve forecast skill to meet accuracy and confidence thresholds required for decision-making and risk management

### **Strategies for Achieving:**

Achieving this objective will require science and technology strategies, particularly strategies to improve observations. Additionally, the NWS will focus on modeling and prediction strategies to:

- **Forecasts:** Extend temporal scales of weather, coastal, and ocean forecasts, from hours to days and weeks, with improved accuracy and quantification of forecast uncertainty to support decision making and mitigate economic loss;
- **Space Weather Forecasts:** Improve space weather forecasting at global and regional scales for geomagnetic storms, solar flares, and other particles in an Earth system framework while improving data assimilation for application in energy, transportation, telecommunications, and other industries;

- **Aviation Forecasts:**

Improve prediction of thunderstorms, cloud coverage, and visibility to minimize impacts to the national airspace.





Enable Integrated Environmental  
Forecast Services Supporting Healthy  
Communities and Ecosystems

## GOAL 5: Enable Integrated Environmental Forecast Services Supporting Healthy Communities and Ecosystems

High-impact, weather-dependent events, such as extreme temperatures, poor air quality, and the transmission of airborne and waterborne diseases, pose significant risks to the health of individuals and communities. As of 2008, approximately 127 million U.S. residents live in counties where air pollution exceeds national standards, causing decreases in lung function, more frequent asthma-related hospital visits, and premature death. Daily management of chronic illnesses, such as diabetes and cardiovascular diseases, are also affected by temperature, precipitation, and humidity.

These elements also affect the timing and intensity of infectious disease outbreaks, and changes in climate may alter their geographic range and evolution. More frequent heavy rains and flooding can trigger sewage overflows, spilling raw sewage into drinking water supplies, lakes, waterways, and beaches. Other pollutants in our inland and coastal waterways cause harmful algal blooms, dead zones, human illnesses, and concerns about the safety of seafood harvests.

This goal seeks to support NOAA and our partners by linking weather, water, and climate forecasts with biological, chemical, ecological, and other



processes to reduce the impact of health and environmental hazards on our communities and ecosystems.

### Measures of Success:

Reduced incidence of health impacts attributable to air pollution and extreme temperatures; reduced incidence of waterborne illnesses due to improved water and beach quality forecasts

**Objective:** Extend weather, water, and climate forecasts to provide ecological and health-based information and services

### Strategies for Achieving:

- **Interpretive Services:**

Expand interpretive services in collaboration with our partners for persistent events, such as extreme heat or cold; seasonal flooding; drought and other changes in weather, water, and climate systems;

- **Health-Based Forecasts:**

Deliver, with NOAA and partners, information integrated to meet local and regional forecast needs, including: high-resolution ozone, smoke, dust, and particulate matter forecasts; extreme temperatures; and the progression of insect and waterborne diseases;

- **Ecological Forecasts:**

Contribute, with NOAA and partners, the operational backbone for a defined suite of integrated ocean and coastal ecological forecasts and services, based on NOAA

priority forecast areas of beach quality, species progression, dead zones, harmful algal blooms, and disease pathogen progression;

- **Partnerships:** Expand and build partnerships with local, regional, and national health, water, and

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***As of 2008, approximately 127 million U.S. residents live in counties where air pollution exceeds national standards.***

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environmental managers to better understand and meet weather, water, and climate needs and explore new opportunities for collaboration.

**Objective:** Harness evolving capabilities to enable ecological prediction

### Strategies for Achieving:

- **Observations:** Expand weather, climate, and air quality observations, particularly in high-impact areas, to support environmental surveillance relevant to, and in partnership with, public health agencies;

- **Modeling & Prediction:**

Expand air quality predictions for ozone, smoke, dust, and particulate matter, conduct research and develop chemical data assimilation, and coupled meteorological and air quality predictions. The NWS will also collaborate with NOAA and other agencies to initiate development of an ecological



forecasting system, coupling air, land, and water with biological, geological, chemical, and ecosystem processes;

- **Research to Operations:** Implement test bed framework to accelerate transition of ecosystem and health prototypes into operations and services.



# GOAL 6



*Sustain a Highly-Skilled,  
Professional Workforce Equipped  
With the Training, Tools, and  
Infrastructure to Meet Our Mission*

## GOAL 6: Sustain a Highly-Skilled, Professional Workforce Equipped with the Training, Tools, and Infrastructure to Meet Our Mission

Whether issuing warnings, producing forecast products, engaging with users, managing programs, or supporting our operations, the people of the NWS are what make it a great organization. Our priority as we move towards impact-based decision support services is the sustainment and professional development of our workforce.

This means strengthening the skills and capabilities that will allow our workforce to be successful in the future through training and recruitment. It also means investing in and developing future leadership talent, and continuing our commitment to diversity.

To be successful, our workforce must be equipped with the necessary tools and infrastructure. We cannot meet the first five goals of this Strategic Plan without the investment in and sustainment of information technology and physical infrastructure.

### Measures of Success:

Future workforce skills and capabilities identified and aligned with training and recruitment; improved employee satisfaction; operational collaboration and knowledge-sharing tools for NWS workforce; increased high performance computing capacity; expanded and sustained facilities and infrastructure; expanded availability and interoperability of environmental data

**Objective:** Enhance knowledge and skills of our dedicated workforce

### Strategies for Achieving:

#### • Training:

Train workforce in climate science to make NWS a strong partner in the delivery of NOAA climate services;

Enhance development and training programs to improve and expand leadership, management,

and technical competencies of the entire NWS workforce;

Implement new and enhanced methods and technologies for training delivery, such as simulations and on-demand training integrated into applications and other systems.

- **Diversity:** Continue to promote and expand policies, programs, and practices that lead to a diverse workforce at all levels of the organization;
- **Recruiting:** Improve recruitment strategies to ensure future workforce skills align with NWS vision, including hiring scientists, meteorologists, and hydrologists with exposure to disciplines relevant to evolving NWS needs, and modelers with the technical skills required for data assimilation and numerical modeling;
- **Succession Planning:** Develop new strategies for addressing both short and long-term workforce and leadership requirements to meet emerging national and NWS needs.

**Objective:** Provide state-of-the-science, reliable, secure, and extensible infrastructure

## Strategies for Achieving:

- **Information Technology & Communications:**

Transform information technology and communication infrastructure to accommodate new requirements, based on smart, cost-effective, and sustainable approaches;

- **Communication & Collaboration:** Use emerging technologies and other tools to improve communication, collaboration, and knowledge sharing internally and with our users and partners;

- **Computing:** Expand and sustain state-of-the-science computing architectures and high-performance computing to achieve modeling and prediction improvements;

- **Observing Systems:** Seek new approaches and opportunities to ensure the integration and sustainment of NWS operational observing and dissemination systems;

- **Facilities:** Expand opportunities to co-locate NWS facilities with key partners, as well as sustain existing facilities through “green” improvements;

Ensure NWS facilities portfolio is appropriately aligned to support a reliable and secure work and living environment.

- **Equipment:** Develop the next generation forecast and decision support system, to include data mining tools, advanced visualization, and interoperability with partner systems.





# COLLABORATION & PARTNERSHIP

To Achieve Our Vision, NWS  
Understands It Must Become  
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# COLLABORATION AND PARTNERSHIP

The complexity of our society and the increasing scientific and environmental sophistication of our users requires the NWS to become one of the most adept institutions in the world at working with others in order to achieve our vision of building a Weather-Ready Nation.

Our role is serving as weather, water, and climate experts. We do not aim to become experts in other sectors or disciplines. For example, NWS does not seek to become a health care agency, but to help the health sector prepare for and adapt to the weather so they may be more effective in the administration and delivery of medical care. Likewise, NWS respects the

mission responsibilities of our federal agency partners while seeking ways to work with them to increase our collective effectiveness.

Our strategic focus on collaboration and partnership includes increasing the capability of our workforce to team with others, empowering our offices to collaborate with other organizations, and an NWS institutional commitment to foster effective partnerships of many kinds. NWS seeks to improve collaboration and partnership with other organizations, with other sectors, and with other disciplines.

## ***Emergency Managers and the Media – Key Partners for Public Safety:***

The dissemination, communication, and validation of NWS forecasts and warnings to the public depend on the media and the emergency management community. NWS will work closely with local, state, and national emergency managers to better understand the information they need to assess risk and make decisions. NWS envisions interoper-

able technologies that will make collaboration with emergency managers easier and more seamless. The NWS will also continue our close relationship with the electronic media as they too evolve in response to new technologies and forms of communication.

## ***America's Weather and Climate Industry – Strategic Partners to Reach the Public and Impact the U.S. Economy:***

NWS views America's weather and climate industry – the diverse and growing companies, media outlets, and others that create weather programming, provide consulting services, and deliver information to American society – as a key strategic partner that provides valuable services to many businesses while also being an important economic sector in its own right.

With this Strategic Plan, the NWS hopes to contribute to the growth of this sector as well as benefit from new alliances and strengthened relationships. Working together we can extend and enhance critical services for the entire country.



## **Researchers and Academia – Critical to NWS Future:**

Achieving our science and technology objectives will not be possible without the close collaboration and contributions of NOAA's Office of Oceanic and Atmospheric Research (OAR), along with numerous academic and research institutions that provide a greater understanding of the Earth's complex systems and help solve research challenges in the physical and social sciences.

## **Our Sister Line Offices in NOAA – Interdependent:**

The mission offices that comprise NOAA will continue to play a vital role in our day-to-day operations and the success of our future. Likewise, the NWS seeks to increase collaboration across NOAA Line Offices to collectively meet NOAA's long-term strategic goals and to deliver common services based on integrated environmental data and information. These offices are:

- **National Environmental Satellite, Data, and Information Service (NESDIS)** – acquires and manages the Nation's environmental satellites, manages NOAA data centers, provides environmental data, and performs environmental assessments;
- **National Marine Fisheries Service (NMFS)** – conserves, protects and manages living marine resources within the United States;
- **National Ocean Service (NOS)** – protects coastal communities and monitors our coastal, Great Lakes, and deep-ocean waters;
- **Office of Oceanic and Atmospheric Research (OAR)** – provides the research foundation for understanding the complex systems that support our planet;
- **Office of Marine and Aviation Operations (OMAO)** – manages and operates NOAA's ships and aircraft while managing data acquisition technologies;
- **Proposed Climate Service** - In February 2010, the Department of Commerce announced the establishment of a Climate Service to provide assessment services, climate projections, and research to improve predictions and projections, and long-term adaptation services.

## **Federal, State, Local, and Tribal Government – Important Additional Partnership Opportunities Available:**

Looking beyond NOAA, we also rely on the expertise of other government agencies. The NWS vision of the future requires closer collaboration with tribal, local, state, and federal government agencies to provide more integrated, usable, and relevant information and services. NWS must strengthen relationships with many existing partners, while also developing new relationships that better enable integration of environmental information into emerging areas that have economic, environmental, and health impacts.



### ***New Partnerships – An Effective Strategy for Creating Value:***

As NWS seeks to maximize our value to the taxpayers that support us, some of the most effective strategies can involve helping other organizations and agencies understand and better use the information NWS already produces.

Similarly, the NWS can make small changes in NWS products and services to increase their usefulness by better understanding the needs of new partners. This Strategic Plan identifies some of the sectors that underutilize our current and potential information.

### ***International Partnerships – Weather is Global, and so are We:***

NWS collaboration and partnership does not stop at U.S. borders. We will continue to foster global collaboration working through the United Nations process and international agreements. Global cooperation on observations, data exchange, modeling, research and development is key to our continued success, as well as providing global leadership in setting meteorological standards and building partnerships to protect lives and property.

### ***Public and Educational Institutions – Part of Our Tradition and Part of Our Future:***

Citizen volunteers, stretching back to Benjamin Franklin and Thomas Jefferson, have observed the weather, and, in today's wireless world, produce on-the-scene observations that help NWS produce better warnings.

In concert with the work performed by NOAA's Office of Education, NWS employees will continue to participate in the local community, whether volunteering at science fairs, hosting the public at one of our local offices, speaking out about weather safety, or participating in school career days.

### ***Multi-Disciplinary Teams – Key to Future Successes:***

Recruiting and sustaining a world-class NWS workforce will continue to be a priority. To increase the value of NWS information, we seek to expand our skill set and work closer with partners in other disciplines: economists, sociologists, communication specialists, and others schooled in the social sciences; information technology and information management experts; ecologists and biologists within NOAA and elsewhere; project managers, engineers; logisticians and equipment repair technicians; and specialists in

other areas. NWS sees a future where success is a team effort with many disciplines needed. The ability of the NWS workforce to recognize the need for expertise outside traditional areas and to work effectively on multi-disciplinary teams is essential to the vision in this Strategic Plan.



# IMPLEMENTATION

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# IMPLEMENTATION

The success of our strategy relies not only in the Strategic Plan itself, but also on our ability to implement it. Our strategy must be integrated into everyday decision making, reflected in our resource investments, and supported by all of our employees. Management processes must be fine-tuned to support strategic decisions at all levels and encourage integration with budgeting and performance management.

To guide the implementation of the Strategic Plan, NWS is developing a roadmap and implementation plans. These efforts will describe in more detail how and when we will execute the objectives and strategies needed to achieve our vision and goals. The NWS will continue to seek external comments on proposed new products and services supporting our vision for Building a Weather-Ready Nation.

The NWS Strategic Plan derives from NOAA's Next Generation Strategic Plan, particularly the NOAA goal of a "Weather-Ready Nation" (WRN). The NWS is a full participant in the NOAA strategic planning and budgeting process used to implement and evaluate

progress against NOAA's Next Generation Strategic Plan and by extension the NWS Strategic Plan. NWS maintains a multi-year implementation plan for WRN, including resource-constrained performance targets; helps NOAA evaluate progress toward NOAA's objectives for WRN and other NOAA goals; and formulates the NWS components of the NOAA budget.



# PERFORMANCE EVALUATION

NWS has a Long-Standing Commitment  
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**N**WS has a long-standing commitment to evaluate and report performance in objective and meaningful terms.

The past approach to performance evaluation, embodied in the widely-reported Government Performance and Results Act metrics (e.g., tornado and flash flood lead times) augmented by periodic measures of customer satisfaction in key groups (e.g., emergency managers and water managers), will continue, and NWS will work to develop more comprehensive and meaningful measures of our outputs – the products and services we provide. However, the measures of success expressed in this Strategic Plan also signal NWS's intent to expand upon traditional performance evaluation.

The measures of success express a desired societal outcome that depends not only on NWS outputs, but also on effective societal use of, and response to, these outputs. Performance evaluation based on outcomes is more challenging, but also more meaningful – it seeks to find out how and to what extent NWS products

and services create value for society in terms of economic efficiency, economic output, and improved public safety.

Progress in measuring such outcomes will significantly depend on using work from economics and other social science disciplines. The NWS will use the measures of success as a starting point to develop a detailed plan for how to define, baseline, and track more specific societal measures and targets.



# GLOSSARY OF TERMS



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**Data** – observations, analyses, and forecasts representing weather, water, climate, and/or related conditions produced primarily through automated means, presented numerically, and intended primarily to support further use; e.g., input to other analysis tools, decision tools

**Data and Information Service** – the integration, management, dissemination, and communication of weather, water, and climate data and information, whether pushed by NWS or pulled by the user, and including both the content and the means/method of delivery

**Decision-relevant** – term used to describe NWS products and services that are useful and relevant to those who need to make decisions that are impacted by weather, water, and climate phenomena

**High-impact** – any weather-dependent event that significantly impacts safety, health, the environment, economic productivity, or homeland security

**Impact-based** – term used to describe NWS products and services that communicate the likely societal, economic, or environmental impact of weather, water, and climate events

**Impact-based Decision Support Services** – the overarching paradigm that reflects the NWS vision of the future which focuses on delivering decision-relevant data and information and interpretive services for high impact events

**Information** – broader term that includes “data” as defined above plus the incorporation of human expertise, presented in numerical or non-numerical formats

**Interpretive Service** – the provision of weather, water, and climate expertise delivered in-person or virtually to key decision partners for the protection of life and property

**Partner** – an individual, organization, or entity that aids the NWS mission by providing complementary/additional weather, climate, or water information to NWS or directly to users. In some

cases, NWS Partners will operate under explicit terms and conditions that have been mutually agreed upon, but the general term also applies when NWS Partners pursue goals that aid the NWS mission independent of any explicit agreement.

**Product** – any packaging of NWS information

**Sector-relevant** – term used to describe NWS data and information intended to meet the needs of a user group in an economic sector

**Service** – a product delivered or activity is carried out (advice, interpretation, etc.) that meets the needs of a user or that can be applied by a user

**Stakeholder** – an individual, organization or entity that affects or can be affected by NWS actions

**User** – individuals, organizations, intermediaries, or other entities for whom products and services are provided by NWS

**Weather-dependent** – events caused by weather and events with outcomes depending on weather – e.g., oil spill response and recovery





U.S. DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NOAA's National Weather Service

